



# Federal Regulations and International Treaties

Conference on Marine Vessels and  
Air Quality

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## Overview

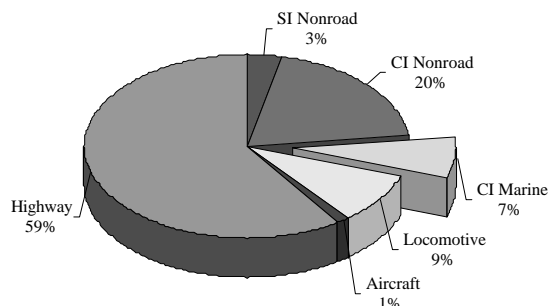
- Background
- MARPOL Annex VI Requirements
  - NO<sub>x</sub> Requirements
  - Projected Results
  - Fuel Requirements
- National Requirements
  - Requirements for Marine Diesel ○ 37 kW
  - Projected Results
  - New C3 Rule

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## Diesel Marine Engines

- Diesel marine engines contribute significantly to ambient air quality
- CI marine emissions concentrated in ports, along coast lines, in river basins
- Most large commercial ports are located in ozone nonattainment areas

**Distribution of 2000 Mobile Source NO<sub>x</sub> Emissions**



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## Regulatory Regimes

- International Maritime Organization
  - MARPOL Annex VI (9/26/97)
    - » Needs ratification by 15 states representing 50% of world's merchant gross tonnage to go into force
- US Clean Air Act Programs
  - Commercial marine diesel engine rule (○ 37 kW)
  - New C3 rulemaking
  - Also--
    - » Nonroad Tier 2 rule (<37 kW)
    - » Recreational marine
    - » SI engine requirements

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## MARPOL Annex VI Requirements

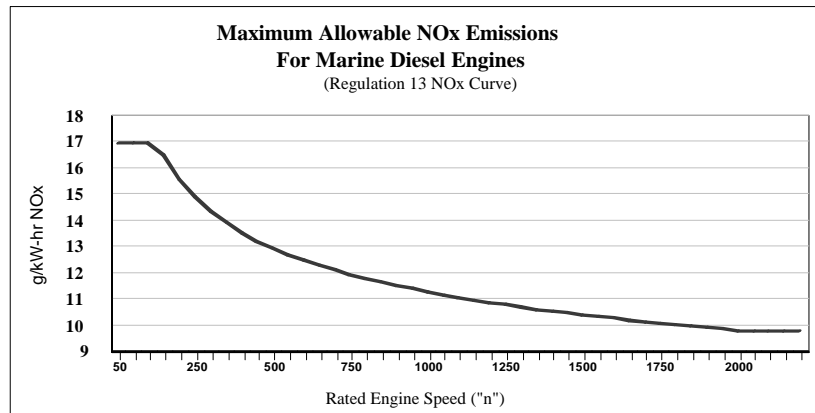
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## MARPOL NOx Requirements

- Annex VI engine requirements are for NOx only
  - Apply to engines > 130 kW
    - » Installed on a ship constructed on or after 1/1/2000
    - » Undergoing a major conversion on or after 1/1/2000
  - Limits are based on engine speed - NOx Curve
    - » Varies from 17 g/kW-hr for very large engines to 9.8 g/kW-hr for smaller engines (○ 2000 rpm)
  - Countries can set different standards for domestic fleet

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## MARPOL NOx Requirements



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## MARPOL NOx Requirements

- Engine owner has active role in demonstrating continued compliance
  - Engine certificate (EIAPP) is issued to the engine manufacturer
  - But, owner must ensure engine is operated and maintained as specified
    - » IAPP: to obtain vessel certificate, vessel must have certified engines
    - » Periodic surveys and inspections
  - Ships should be equipped with MARPOL engines prior to entry into force -- compliance may be retroactive

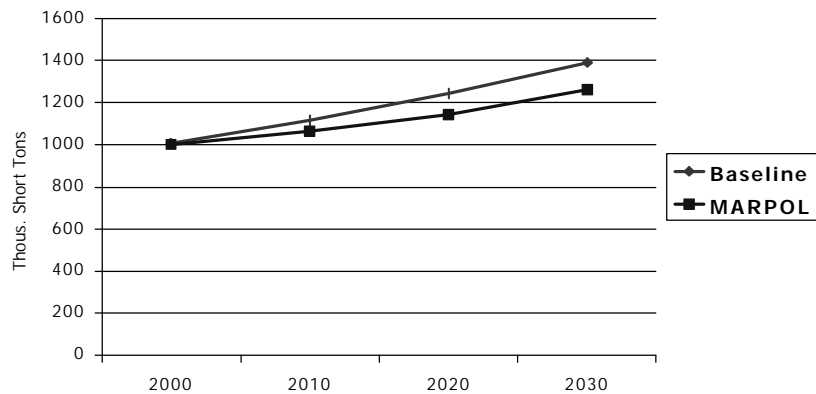
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## MARPOL NOx Requirements

- For compliance purposes, 2 engine-related documents must be kept onboard the vessel
  - Engine Technical File
    - » Various engine technical and emissions information
    - » Onboard NOx verification procedure
    - » Copy of parent engine test report
  - Engine Record Book of Engine Parameters
    - » All engine parameter changes which may affect the engine's NOx emissions must be recorded

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## Emission Projections - NOx



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## MARPOL Fuel Requirements

- Very large ocean-going vessels use residual fuel
  - Sulfur content can be up to 70,000 ppm (7.0%)
  - World average is approximately 35,000 ppm (3.5%)
  - US nonroad distillate: 2,000 to 3,000 ppm
    - HD2007 requires 15 ppm
- SOx Requirements (Regulation 13)
  - Maximum sulfur content: 45,000 ppm (4.5%)
  - SOx Emission Control Areas
    - » Baltic Sea, North Sea designated
    - » Sulfur content: 15,000 ppm (1.5%) or less

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## MARPOL Fuel Requirements

- Fuel Oil Quality (Regulation 18)
  - Additional fuel requirements
  - Compliance demonstrated by bunker delivery note
- Shipboard Incineration (Regulation 16)
  - Requirements for incineration, incinerators
  - Sewage sludge and sludge oil can be burned in the main or auxiliary engines
    - » But -- only if generated during the normal operation of a ship, and only if outside ports, harbors, estuaries

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# National Marine Engine Requirements

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## US Marine Engine Requirements

- Marine engine standards are contained in several rules, different parts of CFR

US Marine Engine Standards

Engine	Rule	Date Finalized	FR Cite	CFR Cite	1 <sup>st</sup> Model Year
All diesel < 37 kW	Nonroad Tier 2	10/23/98	63 FR 56967	40 CFR Part 90	1999
Commercial, auxiliary diesel ○ 37 kW	Commercial marine diesel	12/29/99	64 FR 73300	40 CFR Part 94	20004
Recreational diesel and gasoline SD/I	Recreational SI	ANPRM 12/7/00 NPRM: 9/01 FRM: 9/02	65 FR 76797	N/A	N/A
Outboard, personal watercraft	OB/PWC	10/4/96	61 FR 52088	40 CFR Part 91	1997
SI auxiliary < 19 kW	Small nonhand-held engine	3/30/99	64 FR 15208	40 CFR Part 90	2001

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## Marine Diesel ○ 37 kW

- Standards for commercial marine engines ○ 37 kW are by category

Engine Category Definitions

Category	Displacement per Cylinder	Basic Engine Type
1	disp. < 5 liters (and power ≤ 37 kW)	Nonroad
2	5 ≤ disp. < 30 liters	Locomotive
3	disp. ≥ 30 liters	Unique, "Cathedral"

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## Marine Diesel ○ 37 kW

- C1, C2
  - Limits, technology similar to nonroad Tier 2 program
    - » Internal engine design, turbocharging, better engine cooling, electronic controls
  - MARPOL NOx limits are voluntary until effective dates of national standards
- C3
  - No standards finalized for C3 engines
  - MARPOL standards to apply pursuant to Annex VI
- Ships should be equipped with MARPOL engines prior to entry into force -- compliance may be retroactive

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## Marine Diesel ○ 37 kW

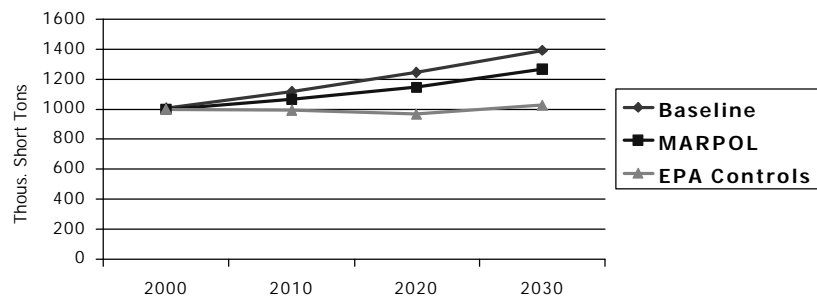
Final Emission Standards and Dates - Commercial Marine Diesel ≥ 37 kW

Category	Displacement (liters/cylinder)	Starting Date	NOx+HC (g/kW-hr)	PM (g/kW-hr)	CO (g/kW-hr)
1	power ≥ 37 kW disp. < 0.9	2005	7.5	0.40	5.0
	0.9 ≤ disp. < 1.2	2004	7.2	0.30	5.0
	1.2 ≤ disp. < 2.5	2004	7.2	0.20	5.0
	2.5 ≤ disp. < 5.0	2007	7.2	0.20	5.0
2	5.0 ≤ disp. < 15	2007	7.8	0.27	5.0
	15 ≤ disp. < 20, and power < 3300 kW	2007	8.7	0.50	5.0
	15 ≤ disp. < 20, and power ≥ 3300 kW	2007	9.8	0.50	5.0
	20 ≤ disp. < 25	2007	9.8	0.50	5.0
	25 ≤ disp. < 30	2007	11.0	0.50	5.0
3	disp. ≥ 30	No standards finalized; MARPOL limits apply			

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## Marine Diesel ○ 37 kW

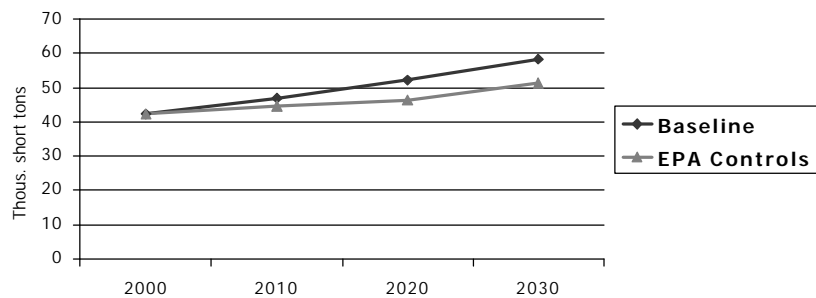
Commercial CI Marine Engines  
Emission Projections - NOx



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## Marine Diesel ○ 37 kW

Commercial CI Marine Engines  
Emission Projections - PM



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## User Responsibilities

- Engine manufacturers are responsible for demonstrating compliance for engine's useful life
  - Also, engines must meet the standards under real operating conditions (not-to-exceed zone)
- Owner/operators also have responsibilities:
  - » Install certified engines on new vessels
  - » Rebuild/remanufacture engines to original specs
  - » Repower engines to original specs if new certified engine can't be used
  - » No tampering
  - » Comply with label and warranty requirements
  - » Use appropriate aftermarket parts

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## C3 Marine Diesel Engine Rule

- Settlement Agreement with Earth Island Institute
  - Finalized 1/19/01
- EPA to set NOx standards for these engines
- Request comment on applying the standards to foreign flag vessels as well
- Timeline
  - » NPRM due 4/02
  - » FRM due 1/03

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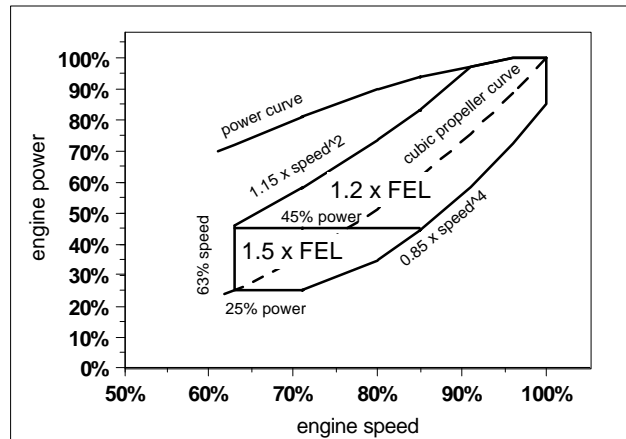
For more information, visit our  
website

[www.epa.gov/otaq/marine.htm](http://www.epa.gov/otaq/marine.htm)

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## Appendix 1

- Illustration of not-to-exceed zone



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## Appendix 2

### ■ MARPOL Annex VI Certificates

- Engine International Air Pollution (EIAPP) Certificate
  - » Issued by US EPA
  - » Due to 1/1/2000 effective date, EPA is already issuing Statements of Voluntary Compliance
  - » Process to exchange for EIAPP later
- International Air Pollution Prevention (IAPP) Certificate
  - » Issued by Coast Guard
  - » Vessel's engines must comply with Annex VI

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